
Telecommunications Theory

The explosive growth of telecommunications traffic in recent years continues to generate ever-increasing demands for radio spectrum while greatly increasing the loading of many telecommunications networks, both wireless and wireline. Yet the radio spectrum is a limited resource. In response to these realities, new radio technologies are being developed and implemented to use spectrum more efficiently and effectively. Also, the basic paradigm of radio spectrum management is beginning to move away from traditional, top-down frequency-assignment methods and is migrating toward autonomous, interference-limited technologies that allow dynamic reassignment of radio frequencies. But to fulfill the promise of more autonomous, locally self-controlled spectrum use schemes, the effects of noise and interference on radio receiver performance must be thoroughly understood, and such knowledge must be focused on improvements in the performance of both existing and new networks. Tools to monitor the quality of audio and video information on communication channels also must be developed and used so that audio and video quality levels can be accurately adjusted in real-time to achieve maximal quality with minimal use of available bandwidth.

To achieve these goals for the U.S. Government as well as the private sector, the Telecommunications Theory Division performs research in both wireless and wireline telecommunications, seeking to understand and improve telecommunications at the most fundamental levels of physics and engineering. Strong ongoing investigations are being maintained in the major areas of broadband wireless systems performance; advanced antenna designs; noise and interference as critical limiting factors for advanced communication systems; audio and video quality assessment; advanced spectrum sharing concepts; and radio propagation.

Through technical publications, cooperative research and development agreements (CRADAs), and interagency agreements, ITS transfers the results of its work in all these technology areas to both the public and private sectors, where the knowledge is transformed into better telecommunications for the United States, new and better products for consumers and the Government, and new opportunities for economic development and growth for the economy.

Areas of Emphasis

Audio Quality Research

The Institute conducts research and development in coding, transmission, and perception-based quality measures for voice and other audio communication systems. Projects are funded by NTIA.

Broadband Radio Research and Propagation Measurements

The Institute conducts an ongoing program of radiowave propagation research and measurements, using the ITS Mobile Radio Propagation Measurement Facility and the Digital Sampling Channel Probe (DSCP). Using these facilities, researchers can determine propagation conditions and impairments which affect new digital communication systems and answer questions regarding the viability of proposed radio services. The project is funded by NTIA.

Effects of Radio Channel on Receivers

The Institute, a recognized leader in radio channel measurement and modeling, is conducting research to assess the effects of interference and noise on the performance of radio receivers and networks. Recent work has focused on the effects of noise and interference as limiting factors in system performance. The project is funded by NTIA.

Video Quality Research

The Institute develops perception-based, technology-independent video quality measures and promotes their adoption in national/international standards. Projects are funded by NTIA.